WHAT IS CLAIMED IS:

1.   A system for determining stiffness parameters of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data.

2.   The system according to claim 1, further comprising multiple sensors arranged to measure vibrations of said structure and output vibration information.

3.   The system according to claim 1, wherein said stiffness parameter unit comprises an iterative processing unit.

4.   The system according to claim 1, wherein said stiffness parameter unit comprises an outer iterative processing unit and an inner iterative processing unit.

5.   The system according to claim 3, wherein said iterative processing unit determines said stiffness parameters using a first order perturbation process.

6.   The system according to claim 3, wherein said iterative processing unit determines said stiffness parameters using a higher order perturbation process.

7.   A system for determining stiffness parameters of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information and determining said stiffness parameters with an iterative processing unit.

8.   The system according to claim 7, wherein said iterative processing unit comprises an outer iterative processing unit and an inner iterative processing unit.

9.   The system according to claim 7, wherein said iterative processing unit determines said stiffness parameters using a first order perturbation process.

10.   The system according to claim 7, wherein said iterative processing unit determines said stiffness parameters using a higher order perturbation process.

11.   A stiffness parameter unit for determining stiffness parameters for a structure, comprising:

an input for receiving vibration data related to the structure;

an analyzer for converting said vibration data to spectral data; and

an interative processing unit for receiving said spectral data and outputting said stiffness parameters using natural frequencies of the structure.

12. A stiffness parameter unit for determining stiffness parameters for a structure, comprising:

an input for receiving vibration data related to the structure;

an analyzer for converting said vibration data to spectral data; and

an interative processing unit for receiving said spectral data and outputting said stiffness parameters using a perturbation process.

13. The stiffness parameter unit according to claim 12, wherein said perturbation process comprises a first order perturbation process.

14. The stiffness parameter unit according to claim 12, wherein said perturbation process comprises a higher order perturbation process.

15. A system for determining damage information of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information;

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data; and

a damage information processor for receiving said stiffness parameters and outputting damage information.

16. The system according to claim 15, wherein said damage information processor outputs damage location information or extent of damage information.

17. A system, comprising:

a structure;

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data.

18. The system according to claim 17, further comprising a damage information processor for receiving said stiffness parameters and outputting location of damage.

19. The system according to claim 18, wherein said damage information processor comprises a damage location processor for determining damage location information.

20. The system according to claim 18, wherein said damage information processor comprises a damage extent processor for determining extent of damage information.

21.   The system according to claim 18, wherein said damage information processor comprises a damage extent processor for determining extent of damage information and a damage location processor for determining damage location information.

22.   The system according to claim 17, wherein said sensor comprises a velocimeter.

23.   The system according to claim 17, wherein said sensor is attached to said structure.

24.   The system according to claim 17, wherein said sensor is not attached to said structure.

25.   The system according to claim 17, wherein said stiffness parameter unit further comprises a spectral analyzer.

26.   The system according to claim 17, wherein said structure comprises a beam.

27.   The system according to claim 17, wherein said structure comprises a truss.

28.   The system according to claim 17, wherein said structure has a longest dimension less than 1.5 meters.

29.   The system according to claim 17, wherein said structure has a longest dimension less than 2.5 meters.

30.   The system according to claim 17, wherein said structure has a longest dimension less than 10 meters.

31.   The system according to claim 17, wherein said structure has a longest dimension less than 50 meters.

32.   A device, comprising:

a random signal generating unit for generating first and second outputs;

a random impact actuator for receiving said first and second outputs; and

an impact applicator coupled to said random impact actuator and having an impact region;

wherein said random impact actuator drives said impact applicator such that the force and arrival times of said impact applicator at said impact region are random.

33.   The device of claim 32, wherein said random impact actuator drives said impact applicator in accordance with said first and second outputs.

34.   The device of claim 33, wherein the first and second outputs comprise independent random variables.

35.   The device of claim 34, wherein the first and second outputs determine the force and arrival times, respectively, of the impact applicator at the impact region.

36.   A system, comprising:

a structure;

a random impact device for inducing vibrations in said structure;

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data.

37.   The system of claim 36, wherein the random impact device comprises:

a random signal generating unit for generating first and second outputs;

a random impact actuator for receiving said first and second outputs; and

an impact applicator coupled to said random impact actuator and having an impact region;

wherein said random impact actuator drives said impact applicator such that the force and arrival times of said impact applicator at said impact region are random.

38.   The device of claim 37, wherein said random impact actuator drives said impact applicator in accordance with said first and second outputs.

39.   The device of claim 38, wherein the first and second outputs comprise independent random variables.

40.   The device of claim 39, wherein the first and second outputs determine the force and arrival times, respectively, of the impact applicator at the impact region.

41.   A system for determining stiffness parameters of a structure, comprising:

        a sensor arranged to measure vibrations of said structure and output vibration information; and

        a stiffness parameter unit for receiving said vibration information, determining mode shape information, and determining the stiffness parameters of said structure using said mode shape information.

42.   The system according to claim 41, further comprising multiple sensors arranged to measure vibrations of said structure and output vibration information.

43.   The system according to claim 41, wherein said stiffness parameter unit comprises an iterative processing unit.

44. The system according to claim 41, wherein said stiffness parameter unit comprises an outer iterative processing unit and an inner iterative processing unit.

45. The system according to claim 43, wherein said iterative processing unit determines said stiffness parameters using a first order perturbation process.

46. The system according to claim 43, wherein said iterative processing unit determines said stiffness parameters using a higher order perturbation process.